STAT:3200 - APPLIED LINEAR REGRESSION   Fall 2023

(Cross References ISE:3760 IGPI:3200)

Class meeting: MWF 2:30–3:20 pm in 40 SH

Instructor: Prof. Erning Li, 231 SH, 335-0820, *erning-li@uiowa.edu*

Office hours (drop-in hours): MWF 1:00–2:00 pm, and by appointment.

Grader: Frazier, Olivia, *olivia-frazier@uiowa.edu*

Please contact the grader in case of grading issues about homework.

Department Information: Department of Statistics and Actuarial Science, 241 SH, 335-2082. DEO: Professor Kung-Sik Chan, 241 SH, 335-0712, *kung-sik-chan@uiowa.edu*

ICON Course Website: Course materials including syllabus, lecture notes, homework assignments, supplemental materials, data, answer keys, grades, etc. will be posted on ICON *https://icon.uiowa.edu/*.

Communication: UI Email—have your UI email address in the class roster and use it when corresponding with Prof. Li via email (state the course number or title in your email). Important announcements to the class will be emailed via the ICON class roster.

Lecture Notes: My lecture notes posted on ICON in advance will be intensively used. Students are strongly recommended to diligently take additional notes in class.

There is no required textbook. Reference books:

Applied Regression Analysis & Generalized Linear Models, by John Fox.
An R Companion to Applied Regression, by John Fox and Sanford Weisberg.

Course Prerequisite: STAT:2010 or STAT:2020 or STAT:3120.

Students should have had relatively comprehensive training in fundamental statistics, e.g., fundamental knowledge and understanding of probability, distribution, random variable, discrete and continuous distributions, sample and population, statistics and parameters, point estimation, confidence interval, hypothesis tests such as one-sample and two-sample problems, and correlation. No prior knowledge of R computing is required.

Course Description and Objectives: Regression analysis with focus on methodology and theoretical background, applications and hands-on data analysis with computer software (primarily R). In this course, students learn strategies to handle various types of data analysis and theoretical reasoning behind, and meanwhile the use of R to aid computations.

Upon completion of the course students are expected to

- acquire strong foundation in classical methods required for analysis of various data types, including modelling, estimation, inference, computation and interpretation/delivery of statistical findings;

- have a good understanding of theoretical foundation and reasoning behind methodology and applications;
- be able to conduct comprehensive and thorough data analysis using classical methods;
- gain critical thinking in data analysis and be able to evaluate or improve data analysis.

R Software: Computing using R is taught and required throughout the semester. R lab sessions will be announced in class in advance and incorporated into lectures.

R is open-source statistical software—one the most popular and powerful for data analysis. It is freely available at *https://www.r-project.org/* and can be downloaded to personal computer for free use. It is also available on the university Virtual Desktop and at the Instructional Technology Centers (ITCs) such as 41 SH.

Homework: Regular homework will be assigned periodically in ICON; assignments are 1 to 1.5 weeks long. Students will turn in their assignment using file upload in ICON by its due date and time. Please submit your homework in Word doc, pdf files, or clear, readable scans/images of reasonable size. Please double check your submission each time, as points will be deducted if submission cannot be opened or read, or has missing pages. All homework assignments are essential, vital practices and will be counted towards overall grade.

Most homework are like mini projects with my step-by-step instructions to combine modeling, theory, methods, and computation to conduct comprehensive hands-on data analyses. Students are highly recommended to learn and practice statistical thinking via these assignments.

Unless prior or prompt arrangements are made for reasons judged to be acceptable by Prof. Li, homework turned in after it is due will receive 0 (zero) credit. Homework submitted via email to me or grader won't be accepted/graded. Additionally, as answer keys will be posted soon after an assignment is graded, late homework submission will only be considered in exceptional circumstances and with prior or prompt notification.

Students are allowed to discuss homework assignments, but everyone should do their own programming and write up their own individual answers. If "blind copying" in a student's answer sheets is identified, all involved students will receive zero score and be considered as plagiarism. Discussions among students can be posted on the ICON Discussion Boards; notice that Discussion Board posts are public that everyone in the class will be able to read all of the posts and responses, and respond to them.

Exams:

Midterm Exam 1	**Wednesday, October 4**, 2:30-3:20.
Midterm Exam 2	**Wednesday, November 8**, 2:30-3:20.
Final Exam	**TBA by the University**
	comprehensive with emphasis on newer materials.

You can bring <u>one</u> standard letter-size (8.5in × 11in like regular printer paper) sheet of paper with anything you want written or typed on both sides to each midterm exam, and <u>three</u> such self-prepared help sheets to the final exam. Also bring a scientific calculator (any type) to each exam. Other than these, all exams are closed-book and closed-notes.

Any unexcused absence from an exam will result in a score of zero with no opportunity for a makeup. A makeup exam (different but equivalent to the original) will be considered only with documentation of reasons required by the university policy and under prior or prompt arrangement made with Prof. Li, and it should be scheduled as soon as possible.

All exams and makeups are proctored and in-person. These exam rules apply to all exams and makeups.

The midterm exams are given at regular class meeting times. The final examination date and time will be announced by the Registrar generally by the fifth week of classes. It is your responsibility to know the date, time, and place of the final exam. Do not schedule your end-of-semester travel plans until the final exam schedule is announced by the University.

Grading: A numerical overall score on the scale of 0 to 100 will be determined according to the following breakdown

Homework	17%
Midterm 1	25%
Midterm 2	25%
Final	33%

Conversion of these scores into letter grades will be made according to the following scale:

$$[90, 100] \text{ A}; \quad [80, 90) \text{ B}; \quad [65, 80) \text{ C}; \quad [50, 65) \text{ D}; \quad < 50 \text{ F}.$$

At the discretion of Prof. Li, depending on class performance and attendance/participation, these ranges may be adjusted, but only downward—criteria will only become easier, not harder.

Plus ($+$) and minus ($-$) gradings will be given as deemed appropriate. A+ grade will be used to indicate rare and extraordinary academic achievement.

Integrity of Course Materials: I request that you preserve the integrity of the course materials. This means that under no circumstance should you make public (either in print or via web postings, social networks, etc.) or disseminate any course materials such as lecture notes, handouts, assignments, exams, solutions, recordings, reference books, etc. You must also strive to avoid making use of any solutions provided by anyone outside of this class. Compliance with this request will be considered part of the academic honesty requirements discussed further below under Administrative Policies.

Attendance and Classroom Environment: Participation in course activities is very vital to your success in this course. Students are expected to attend all lectures. Roll may be taken on random days. Students who are absent from class without acceptable excuse should not seek help regarding missed lectures during my office hours.

When in class, please refrain from talking on cell phones, texting, using laptops/tablets (if not for note-taking purpose), and prolonged conversation with a fellow student. Wireless-capable devices such as laptops, tablets, smart phones, etc. must be put away during exams.

Topics:

1. Introduction to linear regression

2. Introduction to R computing

3. Examining data

4. Transforming data

5. Review of basic statistics

6. Simple linear regression - estimation

7. Simple linear regression - inference

8. Multiple linear regression

9. Dummy variable regression (ANCOVA)

10. One-way ANOVA

11. Two-way ANOVA

12. Diagnostics of influential data

13. Diagnostics of non-linearity, non-constant variance, and non-normality

14. Diagnostics of multicollinearity

15. Model selection

16. Logistic regression

17. Other topics (e.g., probit regression, tree models) when time permits

Academic Honesty and Misconduct

All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty.

Student Complaints

Students with a complaint about a grade or a related matter should first discuss the situation with the instructor, and finally with the Director or Chair of the school, department, or program offering the course.

Undergraduate students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a "W" will appear on your transcript. The mark of "W" is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar's website. Undergraduate students can find policies on dropping and withdrawing here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

University Policies

Accommodations for Students with Disabilities

Basic Needs and Support for Students

Classroom Expectations

Exam Make-up Owing to Absence

Free Speech and Expression

Mental Health

Military Service Obligations

Non-discrimination

Religious Holy Days

Sexual Harassment/Misconduct and Supportive Measures

Sharing of Class Recordings